EXHIBIT B

EXPERT REPORT ON FIBER LENGTH OF "BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX" (13467)

I. BACKGROUND AND QUALIFICATIONS

1. I have over 37 years of experience in the field of Textile Engineering and Polymer and Fiber Engineering. My experience is summarized in my *curriculum vitae* which is attached as **Appendix A** to this Expert Report.

2. I received my Bachelor of Science Degree in Mechanical Engineering from Istanbul Technical University, Istanbul, Turkey in 1982.

3. I received my Master of Science Degree in Textile Engineering and Science from North Carolina State University, Raleigh, North Carolina in 1985.

4. I received my Ph.D. Degree in Fiber and Polymer Science from North Carolina State University, Raleigh, North Carolina in 1989.

5. From 1983 through 1989, I worked at North Carolina State University as a Research/Teaching Assistant.

6. From 1989 through 1992, I worked at Asten Forming Fabrics, Inc., in Appleton, Wisconsin, as a Process Development Engineer, and a Product and Process Development Manager.

7. From 1992 through 1996, I worked at Auburn University in Auburn, Alabama, as an Assistant Professor in the Textile Engineering Department.

8. From 1996 through 2000, I worked at Auburn University in Auburn, Alabama, as an Associate Professor in the Textile Engineering Department.

9. From 2001 through 2015, I worked at Auburn University in Auburn, Alabama, as a Professor in the Polymer and Fiber Engineering Department.

10. From 2015 to present, I have worked at Auburn University in Auburn, Alabama, as a Professor in the Mechanical Engineering Department.

11. I testified in a deposition in the mid-1990s regarding a forming fabric design, in Opelika, Alabama.

12. I was retained as an expert in a patent infringement case involving air- jet weaving machine operations, from 2000-2001, in Tyler, Texas.

13. I was retained as an expert in a patent infringement case regarding fire resistant fleece knit fabric and garment in Atlanta, Georgia.

14. I was retained as an expert, and gave a deposition, in a patent infringement case regarding knitted fabric sports shoes in Atlanta, Georgia.

15. I was retained as an expert, and gave a deposition, in a case involving Tampico fiber brush manufacturing in Statesville, North Carolina.

16. I was retained as an expert, and gave testimony at trial against the Canadian Border Services Agency, in Ottawa, Canada.

17. I was retained as an expert in a patent case involving geotextiles, and gave deposition in Auburn, Alabama.

18. I was retained as an expert in a patent case involving bioabsorbable knit for which I prepared an expert report.

19. I was retained as an expert in a case involving fiber contents of martial art uniforms.

20. I was retained as an expert in a case involving luggage fabrics.

21. I was retained as an expert in a case involving optical fibers.

22. I was retained as an expert in a case involving endless belts.

23. I am retained as an expert in a case involving medical apparel.

II. INDUSTRY STANDARD MEANING OF

A. PIMA COTTON

1. Species

The botanical name for Pima cotton is *Gossypium barbadense*.

2. Fiber Length

Pima cotton has extra-long staple fibers. The average fiber length of Pima cotton is 1.3125 inch (33.3375 mm) [1].

3. Geography

The Pima cotton is generally grown in the United States; however, it may be grown in other countries as well. Pima cotton was developed in a project by the United States Department of Agriculture (USDA) in 1951.

B. SUPIMA® COTTON

1. Species

The botanical name for Supima® (a trade name) cotton is *Gossypium barbadense*.

2. Fiber Length

Supima® cotton has extra-long staple fibers. The average fiber length of Supima® cotton is 1.41 inch (35.814 mm).

3. Geography

Supima® cotton is generally grown in the United States. It is reported that less than 1% of the cotton grown worldwide and less than 3% of the cotton grown in the U.S. is Supima® [2].

C. EGYPTIAN COTTON

1. Species

The botanical name for the Egyptian cotton is *Gossypium barbadense*.

2. Fiber Length

Egyptian cotton has many grades [3], [4]. The average fiber length of Egyptian ELS (Extra-Long Staple) cotton is 1.57 inch (39.878 mm). There are several variations of Egyptian Giza cotton: Giza 45…Giza 95. In general, the length of Giza cotton fibers vary between 1.173 inch (29.8 mm) and 1.4566 inch (37 mm).The average fiber length of Egyptian Giza 87 cotton fiber is 1.4173 inch (36 mm) and the average fiber length of Egyptian Giza 93 cotton fiber is 1.4566 inch (37 mm).

3. Geography

The Egyptian cotton is generally grown in Egypt, Sudan and Peru; however, it is grown in other countries as well such as China and India.

III. COTTON PRODUCTS AND BYPRODUCTS AT GINNING

Ginning is a process in which cotton seeds and cotton fibers are separated. Cotton ginning machine is made of several individual stations which dry, clean (remove trash, leaves, dirt, foreign materials, etc.), gin (actual separation of seed and fibers) and compress the cotton fibers into a bale. Once the seed cotton is fed into the ginning machine, first, it is dried using hot air. Then, pre-cleaning is done to remove trash (mainly small leaf particles). Then the stick machine removes burrs and pieces of cotton plant. The fibers are then passed to the second drier where moisture is reduced further. Then, the second stage cleaning is done to remove more trash, dirt, and leaves, etc. In the actual ginning process in the gin stand, the seed is separated from the lint (fibers), which is the primary function of the ginning process. Two types of gins are used: saw type is usually used for Upland cotton and roller gins are used for higher quality longer cotton fibers. The seeds fall at the bottom of the machine and are taken away for storage and

further processing. The lint is cleaned further in final cleaning to remove the remaining trash using saw type or air-jet cleaners. Then, the fibers are condensed, pressed into bales and shipped to customers.

A. FULL LENGTH FIBERS

Full length fibers are the fibers obtained from cotton plant that are typically used to make yarns and fabrics. Depending on the cotton variety and therefore length, these cotton fibers can be classified as Pima, Supima®, and Egyptian cotton, etc.

B. BYPRODUCT: SHORTER FIBERS AND WASTE

Short fiber (less than 0.5 inch or 12.7 mm in length) byproducts include fibers that are not long enough to be used in yarn and fabric manufacturing; therefore, they cannot be classified as Pima, Supima®, or Egyptian cotton, etc., fibers. Waste products include foreign materials (trash) in the seed cotton such as dirt, leaf pieces, sticks, etc.

C. BYPRODUCT: LINTER FROM SEED

Linter is very fine fibers that surround the cotton seed to provide protection and cushioning. These fine fibers are obtained in a different process. Cotton linter can be used to produce regenerated cellulosic fibers (using spinning solution), powder, paper and paint materials.

D. BYPRODUCT: SEED

Cotton seed is rich in protein and oil, from which cottonseed oil is produced and used in food industry. Oil extracted seed is fed to the animals.

IV. CRITERIA TO DETERMINE IF COTTON IS PIMA, SUPIMA® OR EGYPTIAN

The main criteria to determine if cotton fiber is Pima, Supima®, Egyptian or another type is the fiber length. ASTM D7641 Standard Guide for Textile Fibers lists the staple length of cotton fibers such as American Upland, Egyptian, American Egyptian, etc.

There are standard test methods that can be used to determine cotton fiber length [5]:

1. ASTM D1440 Standard Test Method for Length and Length Distribution of Cotton Fibers (Array Method). This method determines the fiber lengths of loose fibers.
2. ASTM D1447 Standard Test Method for Length and Length Uniformity of Cotton Fibers by Photoelectric Measurement (Fibrograph Method). This method is suitable to determine the length of raw or partially processed fibers as well as some cotton waste.
3. ASTM D4604 Standard Test Methods for Measurement of Cotton Fibers by High Volume Instruments (HVI) (Motion Control Fiber Information System). This method has been withdrawn.
4. ASTM D5103 Standard Test Method for Length and Length Distribution of Manufactured Staple Fibers (Single-Fiber Test). This is the test method that is suitable to determine the fiber lengths in finished products such as towels.
5. ASTM D5332 Standard Test Method for Fiber Length and Length Distribution of Cotton Fibers. This test method has been withdrawn.
6. ASTM D5867 Standard Test Methods for Measurement of Physical Properties of Raw Cotton by Cotton Classification Instruments

V. EFFECT OF MANUFACTURING PROCESS ON COTTON FIBERS

It is generally believed that the ginning process affects the length of cotton fibers. The effects of ginning and other processes on cotton fiber quality and fiber damage has been researched, sometimes with mixed results. Mangialardi stated that “Data on staple length and

spinning performance in these experiments [lint cotton cleaning with saw cylinder type gin] showed some discrepancies and were, therefore, nonconclusive" [6].

Kirk and Leonard reported that a modified saw-type lint cleaner had no adverse effects on the fiber quality or spinning performance of Pima cotton fibers; i.e., "without significantly decreasing fiber length parameters" [7].

Mangialardi reported that "none of the length parameters measured were significantly affected by the seed-cotton cleaning treatments" prior to actual ginning. However, he reported 1.94% length decrease in the upper-quartile length after three experimental saw-cylinder lint cleaners (the difference between no lint cleaner and one lint cleaner was 0.80%; the difference between no lint cleaner and two lint cleaners was less than 1.69%; the difference between the first and second lint cleaners was less than 0.89%; the difference between the second and third lint cleaners was less than 0.25%). The mean length decrease was 3.9% with three experimental saw-cylinder lint cleaners for the same fibers (the difference between no lint cleaner and one lint cleaner was 2.25%; the difference between no lint cleaner and two lint cleaners was 3.23%; the difference between the first and second lint cleaners was 1.0%; the difference between the second and third lint cleaners was less than 0.70%). For the waste material in the same experiment, the upper-quartile length difference between one lint cleaner and two lint cleaners was 1.47% and the difference between one and three lint cleaners was 1.79% (the difference between two and three lint cleaners was 0.33%). The difference between the mean length of waste material extracted by one lint cleaner and two lint cleaners was 3.65%, and between one lint cleaner and three lint cleaners was 3.85% (the difference between two lint cleaners and three lint cleaners was 0.21%) [6]. It should be noted that most saw gins use two stages of lint cleaners.

Hughs et al., examined the effects of ginning and lint cleaning on fiber length of medium staple Upland cultivar cotton and how this influenced textile processing. They concluded that "some long fiber was lost to lint cleaning at all stages but most of that fiber was not of significant textile value and more than 33% of the fiber lost at any stage was equal to or less than 1.27 cm (0.50 inch) in length". Roller ginning resulted in less shortening of fibers compared to saw ginning. They found out that "although any saw-type lint cleaning clearly reduces fiber length, only excessive lint cleaning (three in this case) greatly reduces fiber length over one saw-type lint cleaner". Length difference between roller gin and saw gin with no lint cleaner was 3.27% for the upper quartile length and 7.05% for the mean length. In saw ginning, using one lint cleaner caused 1.69% length decrease for upper quartile length and 2.67% for mean length. Two lint cleaners resulted in 2.71% decrease in upper quartile length and 2.67% decrease in mean length. Three lint cleaners caused 7.1% decrease in upper quartile length and 8.03% decrease in number averaged length. The length difference between one and two lint cleaners was 1.03% for upper quartile length and 0% for number length average. Between two and three lint cleaners, the difference was 4.52% for upper quartile length and 5.5% for mean length. For the trash lint, the differences for the upper quartile and mean length were as follows, respectively: between one and two lint cleaners, 4.14% and 3.42%; between one and three lint cleaners, 5.80% and 4.57%; between the second and third lint cleaners, 1.73% and 1.18%. They also concluded that "…at least two thirds of the fiber lost to the trash, regardless of the number of series lint cleaners used, was less than 2.21 cm (0.87 inch) in length and not of great textile processing value. A significant percentage of fiber lost, regardless of the amount of saw lint cleaning, was relatively short with over 33% being equal to or less than 1.27 cm (0.50 inch) in length" [8]. Their results show that long fibers are not generally lost to trash. The work of Hughs et al., was done on

Upland cotton fibers, which are shorter than extra-long fibers such as Pima, Supima® or Egyptian cotton fibers. However, it is a relevant study which shows how extra-long staple fibers would be affected by the ginning process. It should also be mentioned that roller type gins are used for extra-long staple fibers; therefore, saw ginning is used for Upland cotton and roller ginning is used for Pima or other extra-long cotton fibers. Roll gins are gentler to the fibers than saw-type gins.

Dyeing and steaming do not affect the cotton fiber length in general. Only in one study, it was reported that raw stock vat-dyeing process reduced fiber length slightly. However, it was also noted that the yarns vat-dyed after spinning have the maximum strength [9].

The final pressing of garments would not reduce the fiber length because it is usually done in moist conditions which reduce the brittleness of the cotton fibers and increase their tensile strength.

Pilling is an issue usually with synthetic fibers/cotton blends, such as polyester/cotton blends. 100% synthetic fibers can also have pilling. However, 100% cotton fabrics usually do not have pilling problem. Some anti-pilling treatments will remove the protruding fibers from the surface to prevent pilling (again usually in synthetic/cotton blends) and therefore may shorten the overall fiber length. However, there are no quantitative data on this length reduction. Even if a manufacturer uses an anti-pilling treatment on 100% cotton fabrics, the length of fiber protrusion from the fabric surface is small such that it would not reduce the length of Pima, Egyptian or other ELS cotton fibers from their original lengths to the lengths found in the tests. Otherwise, the fibers should have protruded a lot from the surface, making it a very hairy fabric to begin with, which is not the case in normal fabrics. It should be noted that for new, unused products, pilling is irrelevant.

It is reported that from yarn to finished fabric, the fiber length gets "slightly shorter" due to "spinning, knitting and weaving". As a result, the fiber length is shortened from 1.448 inch to 1.262 inch or by 12.84% (upper quartile length), from 1.174 inch to 1.016 inch or by 13.45% (weighted length average), from 1.008 inch to 0.842 inch or by 16.46% (number length average) [10].

When interpreting results of ASTM D5103, any shortening by manufacturing process should be taken into account by the qualified individual who is interpreting those results.

From the aforementioned discussion, it is reasonable to conclude that maximum cotton fiber length reduction from the beginning to the end of the manufacturing processes would be 25% at most. This number is based on the worst case scenarios such as saw ginning with three lint cleaners and number length averages (rather than upper quartile or weighted length averages, which usually give smaller percentages of fiber shortening).

VI. DNA TESTING

Recently, it is claimed that DNA testing can be used to prevent cotton fraud. It should be noted that there is no scientific publication about this claim yet. It is believed that DNA testing may be able to confirm species of cotton but cannot determine fiber length. I would like to add that one institution that uses this technology discredits the DNA method of another institution [11].

VII. MIXING OF HIGH QUALITY AND LOW QUALITY COTTON VARIETIES

Important cotton fiber properties that result in high quality and stronger fabrics include fiber length, fiber strength and fiber fineness (micronaire). In general, longer fibers are also stronger and finer, and therefore more expensive.

Some manufacturers of yarns and fabrics, particularly manufacturers outside of the United States, have been found to mix cotton by-products, as explained above, and cheaper varieties of shorter fiber cotton with Pima, Supima® and Egyptian cotton and still claim that their products are made of 100% Pima, Supima® or Egyptian cotton. For example, it is reported that a "garment already at retail labeled PIMA COTTON" had the weighted upper quartile length of 0.70 inch, weighted average length of 0.54 inch and numbered average length of 0.42 inch" [10]. These numbers are well below the typical length of Pima, Supima® or Egyptian cotton fibers even after allowing the possible shortening during the manufacturing processes.

The motive is greed. By unfair and unethical practice, those manufacturers want to make more money due to the price difference in different varieties of cotton. Although it depends on supply/demand and market conditions, Pima, Supima®, or Egyptian cotton can be up to 3 or more times more expensive than the shorter fiber cotton such as Upland cotton and even more expensive than the shorter fiber by-products. Mixing shorter staple length and therefore less expensive cotton fibers with high staple length and therefore more expensive fibers gives an unfair advantage to those manufacturers. There are estimates that "90% of products labeled 'Egyptian Cotton' are fakes" [12].

VIII. DETERMINING THE TYPE OF COTTON IN YARNS, FABRICS AND FINISHED PRODUCTS

To determine if cotton in a yarn, fabric, or finished textile product is truly 100% Pima, Supima® or Egyptian cotton, the length of the cotton fibers in the sample of yarn, fabric or finished product can be tested by ASTM D5103.

IX. ASTM D5103

I have reviewed the process of testing by TexTest (Columbus, GA) company on **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** sample, using ASTM D5103 test method. I am familiar with D5103 and TexTest's methods. I have been to TexTest's testing facility. TexTest is ANAB accredited and ISO 9001 certified testing facility that is capable of doing standard tests such as ASTM, AATCC, ANSI, CSPS and MIL tests on fibers, yarns, fabrics and finished products. They are a member of ASTM, AATCC, AFMA and IFAI.

X. TESTING BY TEXTEST

I am relying on testing done by TexTest. In the past, I took my students to visit TexTest to see their facilities and testing capabilities. I also used materials from TexTest in my book entitled "Wellington Sears Handbook of Industrial Textiles", which was a best seller [13]. ASTM D5103 is the proper test method to test **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** sample to determine the cotton fiber length in the sample. TexTest is uniquely qualified to do this test and I have full confidence in their testing capability and test results.

XI. ASTM D5103 TEST DONE BY TEXTEST

To determine the length of cotton fibers used in the finished product, textile experts, like myself, would and do rely on ASTM D5103 testing done by a certified testing company such as TexTest on a textile product such as **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** sample. TexTest professionals follow the proper testing guidelines as outlined in the ASTM D5103 test method including apparatus, sampling, conditioning, procedure, calculations and reporting requirements.

XII. FIBERS OF "BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"

I have reviewed the results of the testing done by TexTest. Based on those test results, my education, training and more than 37 years of experience in the textile industry and taking into account any effects on cotton fiber length that may have resulted from manufacturing processes, it is my opinion that **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"**, to a reasonable degree of scientific certainty, is not made of 97% Supima cotton fibers as explained below.

XIII. PRODUCT MADE FROM A MIXTURE OF COTTON FIBERS

It is my further opinion based on my education, training, and experience that, rather than being 97% Supima cotton **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** is instead made from a mixture of cotton and other fibers including a significant amount of less expensive shorter cotton fibers or cotton byproduct fibers. Based on the ASTM D5103 test results of "**BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"**, 15% of the fibers can be classified as Egyptian Giza 87, 93 cotton fiber; 7% of the fibers can be classified as Egyptian ELS; 30% of the fibers can be classified as Supima® and 29% of the fibers can be classified as Pima. 70% of the fibers are shorter than 1.20 inch (30.48 mm) and 49% of the fibers are shorter than 1.08 inch (27.432 mm).

Although there is some shortening of fibers during the manufacturing processes as explained above, the reduction in fiber length during manufacturing would not affect the classification of fibers based on length. As tested, 70% of the cotton fibers in **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** are below the Supima cotton fiber length range as shown in Table 1. Even if we assume that all the fibers

got shortened by 25% during the manufacturing processes *including* the shortening during ginning, which is based on the numbers reported in the literature as explained above and taken as the worst case scenario, then the total number of fibers that would fall under Supima cotton classification would be only 52%, as shown in the last column of Table 1. It should be noted that this is even after assuming that all the 10 fibers that are longer than 1.12 inch are also longer than 1.25 inch, which is highly unlikely. This still would not make **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"** to qualify to be made of 97% Supima cotton fibers. Moreover, from the TexTest Report 13467, it is understood that they only tested the length of cotton fibers in the product. In that case, the total number of fibers that would fall under Supima cotton classification would be even lower, i.e., only 50.44%.

Table 1 Fiber lengths as tested and prior to manufacturing processes (based on TextTest results)

	As Tested		Prior to Manufacturing Processes
	Length Group Lower Limit (inch)	Number of Fibers	Length Group Lower Limit (inch)
	2.040	0	2.720
	1.920	0	2.560
	1.800	0	2.400
	1.680	0	2.240
	1.560	1	2.080
Supima Cotton Range	1.440	6	1.920
	1.320	9	1.760
	1.200	14	1.600
	1.080	21	1.440
	0.960	21	1.280
	0.840	10	1.120
	0.720	8	0.960
	0.600	8	0.800
	0.480	1	0.640
	0.360	1	0.480
	0.240	0	0.320
	0.120	0	0.160
	0.000	0	0.000
	Total:	100	

Therefore, it is my conclusion that **"BROOKS BROTHERS EUROPE SRL SHIRT 97% SUPIMA / 3% LYCRA SPANDEX"**, to a reasonable degree of scientific certainty, is not made of 97% Supima cotton fibers.

References

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